no dampers

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F4V VFBN VG202 VG212 V163

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GB 1468754 A GB 1274540 A GB 1011742 A
EP 0287546 A2 FR 001347152 A

(58) Field of Search
UK CL (Edition L) F4V VFBN
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(54) **Space air heating or cooling device**

(57) A space air heating or cooling device comprises an elongate box-like channel C, a mixing chamber B formed between a side wall 13 of the device and the channel C and a heat exchanger 12 in the upper part of the mixing chamber B. The mixing chamber B has a bottom opening F. The side wall $11b_1$, $11b_2$ of the channel C has air flow openings 14a, $14a_1$ from which fresh air L_2 is directed downwards into the mixing chamber B to induce a flow of room air L_3 via the heat exchanger 12. The combined air flow $L_2 + L_3$ is directed to the side from the mixing chamber bottom opening F by a guide 15. The opening F may be associated with a false ceiling K. The air directing means associated with the openings 14a, $14a_1$ are pressed from the side walls $11b_1$, $11b_2$, or are defined by downwardly directed curved nozzle tubes.

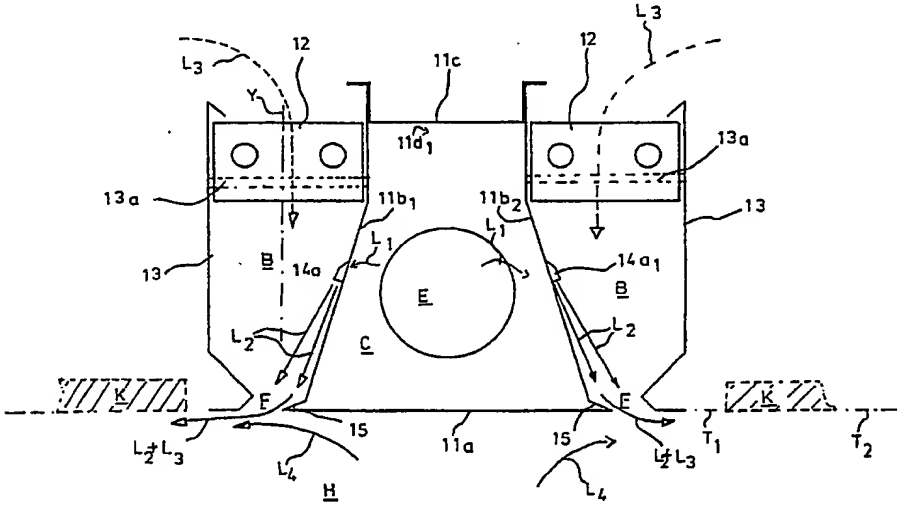

FIG 2

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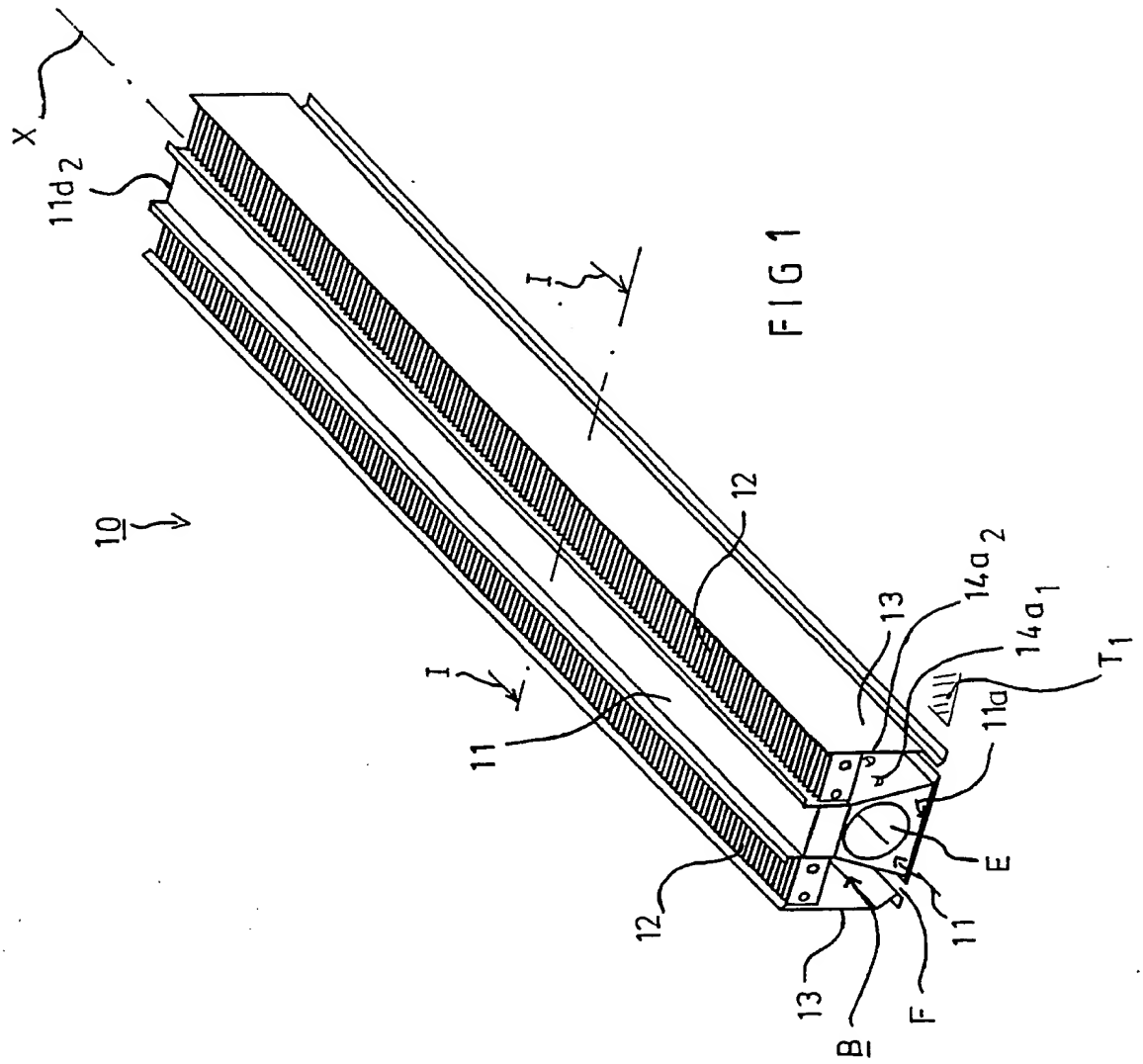


FIG 1

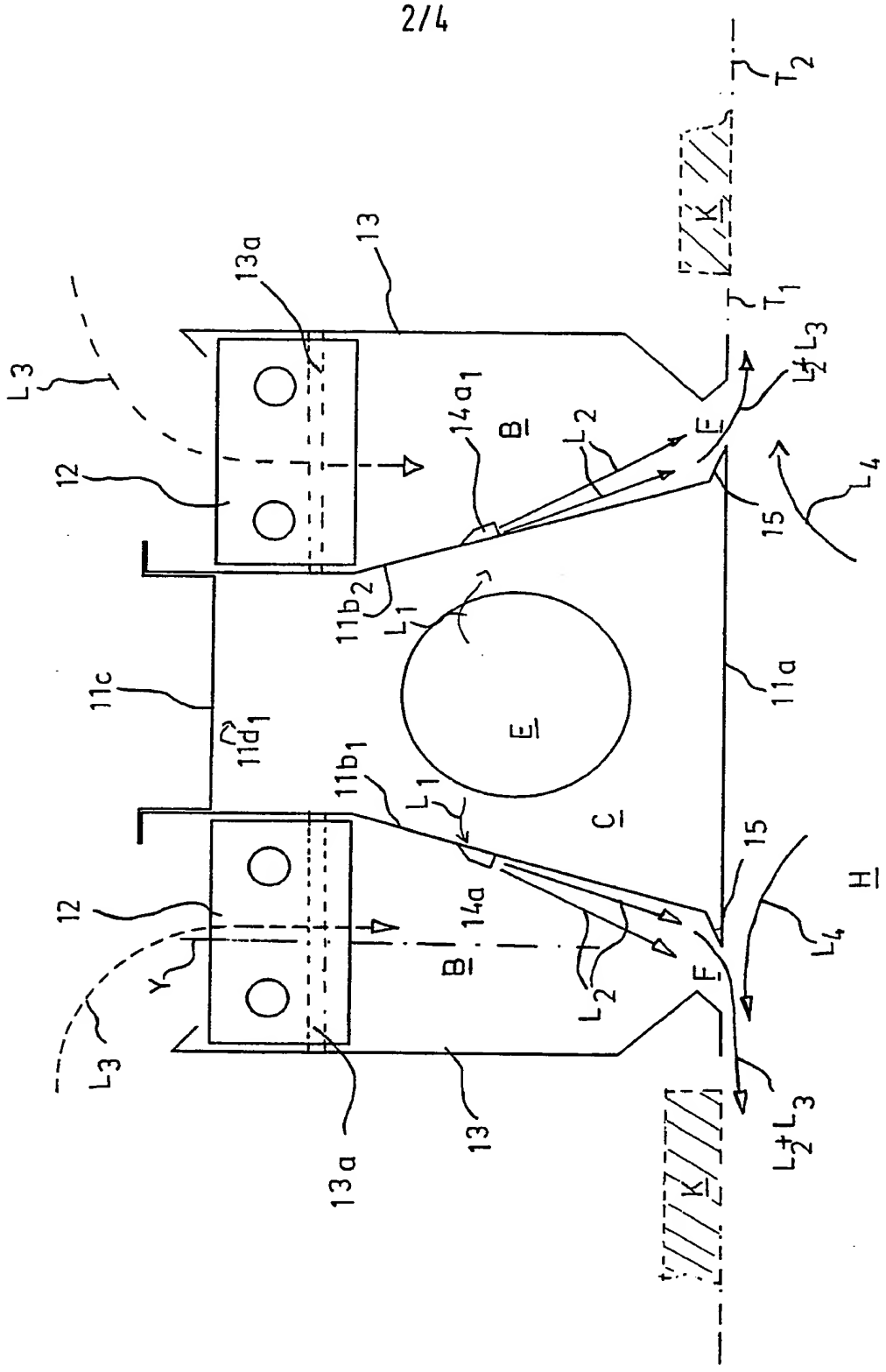

L3
12
13a
13
14a1
B
L2
E
T2
K
T1
L2+L3
L4
15
11b2
L1
11c
11d1
11a
E
11b1
L1
C
15
12
Y
B
14a
L2
F
L4
H
L3
13a
13
L2+L3
K

FIG 2

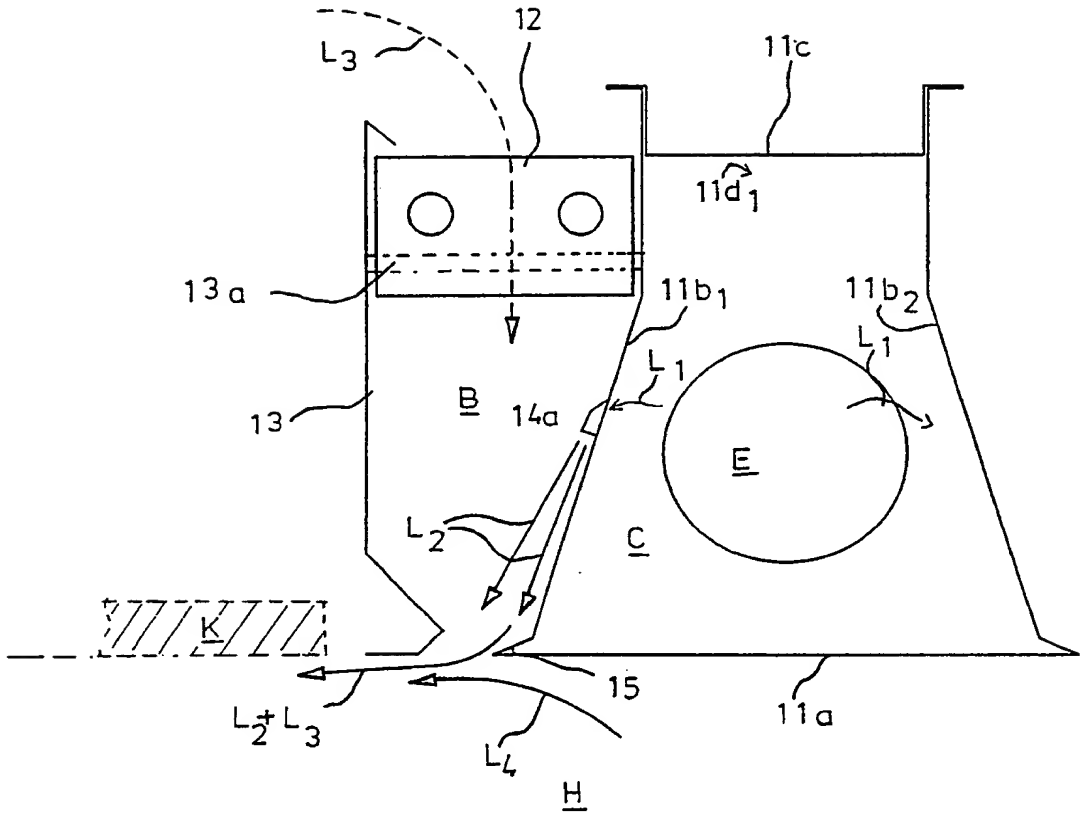


FIG 3

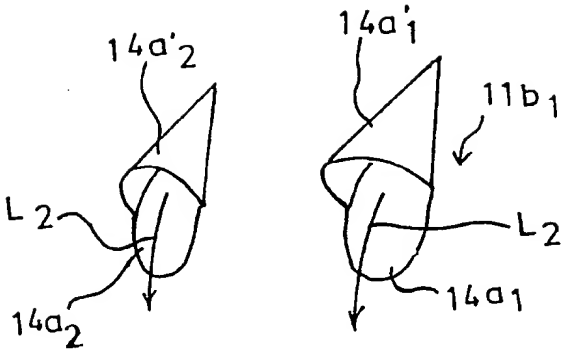


FIG 4

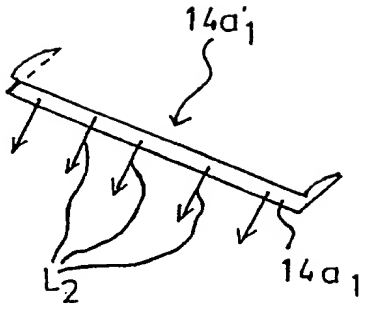
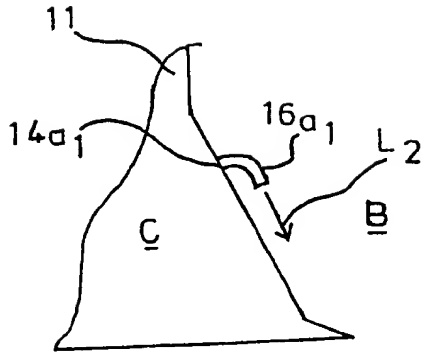


FIG 5

FIG 6



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AIR CONDITIONING DEVICE AND AIR CONDITIONING METHOD

Background of the Invention

The invention relates to an air conditioning device by means of which air is passed into a room space such that the inlet air flow causes room air circulation over at least one heat exchanger. The invention also relates to an air conditioning method.

The applicant's previous FI patent application 891967 discloses a device in which an inlet air flow causes room air circulation over a heat exchanger of an additional heat exchange device. A fresh inlet air flow and a circulating air flow over the additional heat exchanger are directed along the plane of the surface of a heat exchange panel.

SE patent specification 161 701 discloses a device in which an air flow is directed from the side of a channel and an induction flow is achieved by means of air flow over heat exchangers. The device comprises a lower plate on holders, which plate is removable. It is not possible to place the device in the vicinity of the surface plane of a lower roof below the actual room ceiling.

The Invention

The invention provides an air conditioning device as set forth in Claim 1 or 14 and an air conditioning method as set forth in Claim 12 or 15. An attempt has been made to improve the prior art air conditioners. The air conditioning device is formed such that an air flow entering into a channel is discharged from the side of the channel into a mixing chamber and draws room air via the heat exchanger. The combined air flow is directed to the side from the mixing chamber and essentially in the direction in which extends the lower surface of a box of the device.

The most common way of positioning the air conditioning device is to place it directly below the actual roof. The device may alternately be placed such that the lower surface of the box of the device or of the channel is located on the plane of the surface of a separate lower roof, ie. the device may be placed in the plane of the surface of the lower roof. In the latter arrangement, there is connection between the room and the space between the actual ceiling of the room and the lower roof, for circulating the room air via the heat exchanger. One or more additional heat transfer panels may be placed in the vicinity of the lower roof in such a way that the inlet air flow can be caused to sweep the surface of the heat exchange panel. When using the lower

roof, the combined flow readily adheres onto the roof surface due to the Coanda effect. In this way, cooled air does not immediately drop down.

The circulating air cooled by the heat exchanger flows freely downwards within the device of the invention, so that the inlet air coming from the discharge opening of the channel easily and efficiently induces circulating air to move along with it, the directional components of both flows being parallel and directed downwards.

The mixing chamber is open at the bottom. The flow coming out of the mixing chamber is directed within the mixing chamber such that it discharges to the side and preferably in the plane of the lower surface of the device or of a bottom wall of the channel.

The discharge air flow range is wide, i.e. small and large air flows may be blown by means of the device. The air can be discharged from the device over a wide area but the flow rates can be kept low due to the large blowing range available in the device. The air may be blown in one or two directions, depending on the situation.

Preferred Embodiments

The invention is further described, by way of example, with reference to certain preferred embodiments shown in the Figures of the accompanying drawings, to which the invention is not intended to be limited.

Fig. 1 is an axonometric representation an air conditioning device in accordance with the invention.

Fig. 2 is a vertical section along the line I-I in Fig. 1.

Fig. 3 shows an embodiment which comprises only one mixing chamber.

Fig. 4 shows an embodiment in which flow openings from a longitudinal channel are formed by die cutting.

Fig. 5 shows an embodiment in which the flow opening from the longitudinal channel comprises one longitudinal gap.

Fig. 6 shows an embodiment in which flow openings from the longitudinal channel have nozzle tubes.

Fig. 1 shows an air conditioner 10 which comprises a longitudinal elongate box-like channel 11 and one or more

heat exchangers 12 on at least on one side of the channel 11 (in the Figure heat exchangers 12 are shown on both sides of the channel 11). Relative to the longitudinal axis X of an air space C in the channel 11, air is blown sideways from space C into a mixing chamber B whose mixing zone is located below the heat exchanger 12, and flows out of the mixing chamber B through a flow opening F in the bottom of the mixing chamber B. Air is directed within the air chamber B such that when it comes out of the mixing chamber B, it is directed to the side and flows in the direction of a lower surface plane T_1 of the channel 11, and essentially in said plane. Circulating room air L_3 of the room is either heated or cooled by means of the heat exchanger(s) 12; however, the most common usage is only cooling.

The longitudinal channel 11 of the air conditioner 10 comprises flow openings 14a, $14a_2$, $14a_3$... opening into the upper part of the mixing chamber B, near the heat exchanger 12, from which openings the air flow is directed downwards. In this way, the air blown out of the space C in the channel 11 and through the flow openings 14a, $14a_2$..., as indicated by the arrows L_2, induces a circulating room air flow L_3 via the heat exchanger 12; the air blown from the flow openings $14a_1$, $14a_2$... and from the channel 11 draws along with it the circulating room air L_3 such that the

circulating room air passes via the heat exchanger 12, which in the case of cooling expressly cools the circulating air L_3. The air L_3 cooled in the heat exchanger 12 flows downwards, and this air flow thus has the same directional component as the fresh inlet air flow L_2 blown into the chamber B from the flow openings $14a_1$, $14a_2$. The air flow L_3 passed via the heat exchanger 12 combines with inlet air L_2 in the air chamber B. The combined air flow (L_2 + L_3) is directed in the mixing chamber B by means of a slanting surface guide edge 15 within the mixing chamber B below the side wall $11b_1$ or $11b_2$ such that the combined air flow L_2 + L_3 is orientated in the plane of a bottom wall 11a of the channel 11 and is directed to the side and away from the axis X; the slanting surface 15 is at an angle to the vertical axis Y of the mixing chamber B. In this way, the air conditioner 10 may be advantageously placed with its base aligned with the plane T_2 of a lower roof K with the bottom wall 11a of the channel in the plane T_2. As the air is caused to flow in the direction of the surface of the lower roof K, it attaches itself to the underside of the lower roof K by the action of the Coanda effect, and thus prevents stale air accumulating just below the lower roof K, and prevents the air flow dropping e.g. if it is cooled. The combined air flow L_2 + L_3 further induces room air circulation L_4 in the room H. When using the lower roof K it must

be ensured that the room air can circulate into a space between the lower roof K and the actual ceiling of the room and thence to the heat exchanger 12. However, in the most common embodiment of the invention, the device is located entirely below the actual ceiling of the room space; a lower roof construction is then not used.

Fig. 2 shows that the channel 11 comprises a bottom wall 11a, side walls $11b_1$, $11b_2$ and a top wall 11c. The device further comprises end walls $11d_1$ and $11d_2$. Fresh inlet air L_1 is blown (blower not shown) through an inlet opening E into the space C within the longitudinal channel 11. The mixing chamber or chambers B are formed between side walls 13 and the side wall 11b, or side walls $11b_1$, $11b_2$ of the channel 11. The heat exchanger 12 is located in the upper part of each mixing chamber B. The side walls 13 are connected to the channel 11 by holders 13a.

Fig. 3 shows an embodiment of the invention in which the channel 11 comprises flow openings $14a_1$, $14a_2$... into only one mixing chamber B on one side wall $11b_1$ of the channel 11.

Fig. 4 shows an embodiment of the invention, in which the flow openings $14a_1$ $14a_2$... on the side wall of the channel 11 are formed by die cutting; a sheet-metal part

$14a_1'$, $14a_2'$... pressed out in the die cutting forms a hood-like guide part, for guiding the air flow downwards. The guide parts $14a_1'$, $14a_2'$ are made in the same step as the flow openings $14a_1$, $14a_2$... The arrangement of Figure 4 can be incorporated in the device of Figures 1 and 2 or of Figure 3.

Fig. 5 shows an embodiment of the invention in which the side wall $11b_1$ of the channel 11 has only one longitudinal flow opening $14a_1$, whose louvre-like guide part $14a_1'$ forms a guide for guiding the flow downwards and efficiently inducing the air flow to pass in via the heat exchanger 12. The arrangement of Figure 5 can be incorporated in the device of Figures 1 and 2 or of Figure 3.

Fig. 6 shows an embodiment of the invention in which the flow openings $14a_1$, $14a_2$... comprise nozzle tubes $16a_1$, $16a_2$... which are fitted to the flow openings such that the flow L_2 is directed downwards in the chamber B. When using the nozzle tubes $16a_1$, $16a_2$..., the air L_2 coming into the chamber B draws the circulating air flow L_3 in via the heat exchanger 12 in an extremely efficient way. The entire flow cross-sectional area of the tube $16a_1$, $16a_2$ is then available for inducing a suction at the heat exchangers 12. The fresh air L_2 acts as carrier air which directs

the air flow $L_2 + L_3$ towards the flow opening F at the bottom of the chamber B. The arrangement of Figure 6 can be incorporated in the device of Figures 1 and 2 or of Figure 3.

Claims

1. An air conditioning device which comprises a channel, a heat exchanger and at least one side wall, a mixing chamber being provided between the side wall and the channel, the mixing chamber having an opening in its bottom and the channel having in its side at least one air flow opening from which air flow is directed downwards into the mixing chamber, whereby the air flow coming from the opening draws along with it circulating room air flowing via the heat exchanger, and the combined air flow being directed to the side when it leaves the mixing chamber.

2. An air conditioning device according to Claim 1, where in there is a lower surface which slants relative to the vertical which directs the air flow to the side from the mixing chamber and in the direction of a plane of a bottom wall of the channel and substantially in said plane.

3. The air conditioning device of Claim 1 or 2, wherein the flow opening in the channel is in the upper part of the mixing chamber and adjacent the heat exchanger.

4. The air conditioning device of any of the preceding Claims, wherein the flow opening in the channel is adjacent the heat exchanger.

5. The air conditioning device according to any of the preceding Claims, wherein the opening in the channel comprises a hood-like part which guides the air flow downwards.

6. The air conditioning device according to any of Claims 1 to 4, wherein on at least one side of the channel there is only one gap-like flow opening and a louvre-like part for directing the air flow downwards.

7. The air conditioning device according to any of the preceding Claims, wherein the air flow from the channel is directed by means of a guide part immediately adjacent the flow opening, which guide part is made in the same working step as the flow opening itself.

8. The air conditioning device according to any of the Claims 1 to 4, wherein the flow opening(s) comprise(s) nozzle tube(s) via which the air is transferred from the channel to the mixing chamber and directed downwards towards the bottom opening of the mixing chamber.

9. The air conditioning device according to any of the preceding Claims, wherein the channel is box-like, and the heat exchanger is on one side of the channel and in the mixing chamber, between a side wall of the channel and the side well of the air conditioning device.

10. The air conditioning device of Claim 9, where the heat exchanger is in the upper part of the mixing chamber.

11. The air conditioning device of any of the preceding Claims, wherein the channel is of elongate shape.

12. An air conditioning method in which room air ciculates via a heat exchanger into a mixing space on the outside of a channel, fresh air is blown from the channel such that it discharges downwards into the mixing space and draws the room air along with it via the heat exchanger, the circulating room air flow and the fresh air flow mix in the mixing space, and the combined air flow is blown to the side from the mixing space.

13. The method according to Claim 12, wherein the combined air flow is blown to the side from the mixing space such that it flows in the direction of the plane of a bottom wall of the channel and substantially on said plane.

14. An air conditioning device substantially as herein described with reference to and as shown in, Figures 1 and 2 or Figure 3, or Figures 1 and 2 or Figure 3 modified as shown in any of Figures 4 to 6, of the accompanying drawings.

15. An air conditioning method substantially as herein described with reference to Figures 1 and 2 or Figure 3, or Figures 1 and 2 or Figure 3 modified as shown in any of Figures 4 to 6, of the accompanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 -14- (The Search report)	Application number GB 9319569.1
Relevant Technical Fields (i) UK Cl (Ed.L) F4V (VFBN) (ii) Int Cl (Ed.5) F24F	Search Examiner A N BENNETT Date of completion of Search 23 DECEMBER 1993
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- 1,12

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Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
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X	GB 1274540	(SPOORMAKER) whole document	1, 12 at least
X	GB 1011742	(CARRIER) whole document	1, 12 at least
X	EP 0287546 A2	(FAREX)	1, 12 at least
X	FR 1347152	(MARELLI) whole document	1, 12 at least

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